DOCUMENT RESUME

ED 067 591 CG 007 487

AUTHOR	Stewart, Jeffrey E.; And Others
TITLE	The Effects of Different Amounts of Competitive Contingent Rewards on Cooperative Behavior.
INSTITUTION	Washington Univ., Seattle.
SPONS AGENCY	Social and Rehabilitation Service (DHEW), Washington, D.C.
PUB DATE	71
NOTE	23p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Behavioral Science Research; Educational Research; *Group Activities; *Group Behavior; Group Dynamics; Group Status; Group Unity; *Junior High School Students; Reinforcers; *Rewards; Teamwork

ABSTRACT

Recent investigations of the effects on group output of competitive contingencies, reward deliveries to group members contingent upon achieving a higher or lower task rate than another group, have suggested that competitive contingencies are a positive function of group output. When rewards are contingent upon a higher comparison outcome, group task rates increase, and when rewards are contingent upon a lower comparison outcome, the rates decrease. The present investigations examine the effects on group output of reward magnitude during competitive contingencies. The studies, conducted in a special education classroom of a junior high school, demonstrated that the greater the competitive contingent reward, the more likely that group output will increase or decrease according to the competitive contingency in effect, a reward to group members for a higher or lower task output than another group. The procedure employed that was designed to promote organized participation on "teacher directed activities" was the presentation of a "button press" task. (Author/BW)

FILMED FROM BEST AVAILABLE COPY

ED 067591

SRS
CG

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

The Effects of Different Amounts of Competitive Contingent Rewards on Cooperative Behavior[1,2]

Jeffrey E. Stewart
William N. Zelman
Dennis E. Mithaug

Social Process Research Residence RR207
Experimental Education Unit
Child Development and Mental Retardation Center
University of Washington

[1]The research was supported by Grant RD-2794-P-69 from the Social and Rehabilitation Services, Department of Health, Education, and Welfare, Washington, D.C.

[2]For reprints write to D. E. Mithaug, Experimental Education Unit, Child Development and Mental Retardation Center, University of Washington, Seattle, Washington 98105

CG 007 487

A major problem in researching social behavior is identifying dependent variables that reflect significant changes in a given social process. The dependent variables defining cooperation have been identified (Mithaug, 1969) as 1) coordinated interaction and 2) task achievement. Cooperation was functionally defined as coordinated (interpersonal) behavior that results in achievement of a common (group) task. When group members coordinate their actions in order to achieve a common goal, they are cooperating. By observing their coordinated actions and the results of the coordination, task achievement, one can determine 1) if the group is cooperating and 2) how effective the cooperative effort is in achieving the group task.

The effectiveness of the cooperative effort is a question concerning most organizations. For example, the effectiveness of the functions of an organization may vary with changes in environmental conditions, some conditions promoting higher rates of goal achievement while others produce lower rates of progress on the group task.

One environmental condition affecting an organization's rate of output may be the productivity of other organizations which produce similar products. Frequently such conditions promote competition as one strives to produce more products, and/or a higher quality product than the other. Organizational productivity or group task achievement rate may change depending on the competitive contingent rewards in the social system. When payoffs are contingent upon one organization's achieving a higher task rate than another, the productivity of the group may increase. Preliminary research on competitive contingencies and group output offers some support for such a proposition.

An investigation of conditions that produce differential rates of task achievement in three person groups was conducted in a series of studies

exploring the effects of competitive contingencies on group task rates (Stewart, Zelman & Mithaug, 1971). When two three-person groups received monetary payoffs for achieving a higher group task rate, a lower task rate, and then a higher task rate than the other group, the output rate of the group increased, decreased, and then increased again.

This reward contingency, a payoff contingent upon a comparison outcome, lower or higher task rate, affected group productivity in predictable directions, thus offering support to the general proposition that group productivity may on occasion be a function of a competitive contingency. Rewards to group members contingent upon higher comparison outcomes increased group productivity, and rewards contingent upon a lower comparison outcome decreased group productivity.

Although the research reported by the Stewart, Zelman & Mithaug studies supported the proposition, the only procedure demonstrating consistent effects was a payoff for a higher outcome during an A condition followed by a payoff for a lower task outcome during a B condition, followed by a payoff for a higher task outcome during a final A condition.

If the competitive contingent reward is a variable accounting for observed changes in the group task rates, one might expect also that an increase in the magnitude of the reward would increase the probability of the relationship occurring again. The greater the reward contingent upon a comparison outcome, the more likely that the group rate will be observed as a positive function of the competitive contingency.

Reward magnitude was manipulated in the Stewart, Zelman & Mithaug study: a 1¢ reward for a higher-lower-higher comparison outcome during one series of A-B-A condition sequences, and a 2¢ reward for a higher-lower-higher comparison

outcome during another series of A-B-A condition sequences. Both the 1¢ and 2¢ reward contingencies affected group task rates predictably. Therefore, the effects of reward magnitude on the probability of observing the reported relationship between competitive contingencies and group output remain to be demonstrated.

This is the objective of the present research: to investigate the effects on group productivity of the magnitude of competitive contingent rewards.

Description of a "Classroom Laboratory" Method

The experimental investigations described here attempted to identify conditions affecting and controlling competitive and cooperative behavior patterns for marginal attenders and potential dropouts in a special education classroom of a junior high school.

A goal of the program was to decrease rates of inappropriate responses, e.g., talkouts and out of seats, and to increase rates of appropriate responses, e.g., accurate responding to instructional materials. Students were referred to the program by teachers and counselors for remediation in academic and/or "social-emotional" response areas. Deficiencies in either category prohibited successful adaptation to classroom procedures and resulted in 1) a disruption in the instructional patterns established for other students and 2) a discontinuation of students' participation in class directed activities.

Investigation of Procedures to Control Peer Processes

One procedure employed at the beginning of each morning session that was designed to promote organized participation on "teacher directed activities" was the presentation of a "button press" task. During this activity procedures were investigated for developing and controlling intra group cooperation via

inter group competitive contingencies. Employing a researching format and subject population similar to a preceding study (Stewart, Zelman & Mithaug, 1971) the present exploration divides into three studies, each one examining the effects on task output of 1, 2, and 3 point rewards for a higher comparative outcome, Study I; the effects of 1, 2, and 3 points rewards for a lower comparative outcome,Study II; and the effects of 1, 2, and 3 point rewards for a higher, then lower and then higher comparative outcome, Study III.

Apparatus

Each student was situated at a table in front of an electromechanical console. Figure 1 shows the 4" x 12" student console with four electromechanical counters situated horizontally with a light and toggle switch at the far right end. Above three of the counters are three button switches which operate the counters. The fourth counter tabulates minutes.

In addition to the student console are two counters situated side by side in a location visible to all students. When members of a three-person group pressed a designated button on their student console within .1 second of each other a tabulation occurred on the group counter assigned to that three-person group.

- - - - - - - - - - - - - - - -
Insert Figure 1 about here
- - - - - - - - - - - - - - - -

Study I: The Effects on Group Output of 1, 2, and 3 Point Rewards for a Higher Comparative Outcome

Procedures

Students participated in three-person groups with two groups participating at a time. The task was to accumulate points on the group's electromechanical counter situated in front of the group.

The counters were programmed to operate only when the three members each pressed a single pre-designated button switch on his console. With the three pre-designated buttons depressed simultaneously, a circuit was closed activating the groups' electromechanical counters. The rate of circuit closures varied according to the "button press arrangement" or "division of labor" of group members. When two members held down the pre-designated button switch while the third pressed his button frequently and rapidly, circuit closures, and,consequently, point accumulations on the counters, were more rapid than when all three members attempted to press at the same time.

Several button or key press patterns observed in previous studies, Mithaug & Burgess (1967, 1968), Mithaug (1969), are: two holders and a presser--two members hold down their keys or button switches while a third presses rapidly; two pressers and one holder--one member holds down his key or button switch while two members press; three coordinated pressers--three members press their keys simultaneously; and three uncoordinated pressers--members do not press their buttons simultaneously, but rather in some uncoordinated fashion. Generally, the most efficient pattern for accumulating points rapidly has been the presser-holder-holder pattern. Next is the presser-presser-holder pattern, then the coordinated presser-presser-presser pattern, and last is the uncoordinated presser-presser-presser pattern.

Task completion rate is the point accumulation rate of the group counters. This rate varies with 1) the button press pattern employed by the group and 2) the pressing rate of the "presser", person doing the button or key pressing. As the task completion rate is the dependent variable of the research, subjects were not informed of the patterns of coordination that would produce points

most rapidly. However, in all previous research employing this apparatus, the patterns for most rapid task achievements were quickly discovered and task completion rate became primarily a function of the presser's rate of pressing his key or button switch.

The instructions were that 100 points on the counter returned one reward point (the negotiable currency for the classrcom) to the person operating that console. Subjects were not informed of the patterns of coordination that produced points most rapidly.

An A-B-A condition sequence with the group serving as its own control was employed in all experimental sessions. Three sessions with the A-B-A format constituted Study I. In session I the competitive contingent instructions and manipulations were administered during the B condition. Subjects were instructed that 1 extra reward point would be delivered to members of the group achieving a higher number of points on the group counter for a given trial. Each trial lasted one minute and conditions changed every three trials. During the A conditions, competitive contingencies were not in effect.

In session 2 the competitive instructions and mamipulations administered in condition B were that 2 reward points would be delivered to members of the group achieving a higher number of points on the group counter, and in session 3, the competitive instructions during condition B communicated that 3 reward points would be delivered to members of the group achieving a higher number of points on the group counter. There were no rewards for comparative outcomes during A conditions in the three experimental sessions.

Six students (S1, S2, S3, S4, S5, and S6) participated. S1, S2 and S3 comprised Group I and S4, S5, and S6 comprised Group II.

Results

The results for sessions 1, 2, and 3 are presented in Figure 2. Data for session I are identified by the graph headed: Results I; data for session 2 by the graph headed: Results II; and data for session 3 by the graph headed: Results III. A solid line represents cooperative rates for group I and the broken line the rate for group 2.

- - - - - - - - - - - - - - - - - -

Insert Figure 2 about here

- - - - - - - - - - - - - - - - - -

Data from session I do not demonstrate that cooperative rates fluctuate predictably as the contingent reward is introduced during condition B of the A-B-A sequence. The mean rates of Group I during A-B-A conditions were: 547, 547 and 315 points/minute; and for Group II: 438, 253, 442.

Data from session II suggest that cooperative rates fluctuate predictably when a 2 point competitive contingent reward was introduced during condition B of the A-B-A sequence. The graphs displayed a weak demonstration of the predicted relationship, as the mean rates per condition are in predicted directions. The mean rates of Group I during A-B-A conditions were: 579, 628, and 612, and for Group II: 238, 275, and 117. The cooperative rate increases when the 2 point competitive contingent reward was introduced in condition B and then decreased when it was discontinued in the subsequent A condition. One might expect this relationship to hold for session 3 as well.

Data from Session III do not support this expectation. Here a 3 point competitive contingent reward was introduced during condition B of the A-B-A sequence. The mean rates of Group I during A-B-A conditions were: 516, 482, and 222 points/minute; and for Group II: 164, 81, and 140.

Discussion

Our proposition is that increases in rewards for higher comparison outcomes increase the rate of output on the group task. Although Sessions I and II offer support for this notion, session III produced contradictory evidence. In the following study the same experiments were conducted with the reverse contingency, a reward for a lower comparison outcome. Here, the expectation is: the greater reward for a lower comparison outcome, the more likely that group task rates will decrease.

Study II: The Effects on Group Output of 1, 2, and 3 Point Rewards for a Lower Comparative Outcome

Procedures

The same six students and groups participated and the procedures of study I were repeated with changes only in B conditions of the A-B-A sequences. The study was divided into 3 sessions: session I introducing 1 point contingent upon a lower comparison outcome; session II, 2 points contingent upon a lower comparison outcome; and session III, 3 points contingent upon a lower comparison outcome.

Results

The results for session 1, 2, and 3 of study II are presented in Figure 3. Data for session I are identified by the graph headed: Results I; data for session 2, by the graph headed: Results II; and data for session 3 by the graph headed: Results III. A solid line represents task rates for group I and the broken line the task rates for group 2.

Data from session I do not fluctuate predictably when the 1 point reward contingent upon a lower outcome was introduced during condition B of the A-B-A

sequence. The mean rates of Group I during A-B-A conditions were: 527, 582, 502 points/minute; and for Group II: 280, 232, and 358. The rate for Group II decreased and then increased as the competitive contingency was introduced in B and then discontinued in the subsequent A condition. Group I's rates do not follow this pattern.

In session 2, 2 points contingent upon a lower outcome were introduced during condition B. The mean rates for Group I during A-B-A conditions were: 399,474, and 492 points/minute; and for Group II: 395, 432, and 541. The rates did not decrease and then increase as expected during B and subsequent A conditions for either Group I or Group II.

- - - - - - - - - - - - - - - - - -

Insert Figure 3 about here

- - - - - - - - - - - - - - - - - -

In session 3, Results III, 3 points contingent upon a lower outcome were introduced during condition B. Data from this session support expectations for both groups. The task rates decreased and then increased during B and subsequent A conditions. The mean rates of Group I during A-B-A conditions were: 143, 130, and 446 points/minute; and for Group II; 356, 300, and 435 points/minute.

Discussion

Combining findings of studies I and II suggests that the magnitude of the reward for a comparison outcome has a predictable effect on group task rates. In study I both groups were affected predictably for a 2 point reward contingent upon a higher comparison outcome, and in study II both groups were affected as predicted for a 3 point reward contingent upon a lower comparison outcome. The contradictory finding remains, however,

that a 3 point reward contingent upon a higher comparison outcome (Study I, session 3) did not control consistently the task rates for either group.

Study III employs a different method for exploring the effects of different reward magnitudes on group task rates.

Study III: The Effects on Group Output of Different Reward Magnitudes for Higher-Lower-Higher Comparative Outcomes

Procedures

Procedural changes consisted of introducing 1 point rewards for higher comparison outcomes during A conditions of all experimental sessions. Different reward magnitudes for lower comparison outcome were introduced during B conditions. In session 1, the A-B-A conditions were: 1 point for a higher outcome (A), 1 point for a lower outcome (B), and then 1 point for a higher outcome. For sessions 2, 3, and 4, the A-B-A sequence was: 1 point for a higher outcome (A), 2 points for a lower outcome (B), and then 1 point for a higher outcome (A). In sessions 2-4, contingency manipulations were repeated to confirm findings as variations in group composition occurred frequently. On four occasions a member of one of the groups was absent. The vacant console was accessible to other members who adapted to the situation with one member operating two consoles at once.

Eight students participated in this study. Combined in various three-person groupings, they made up six groups. The variations in group composition resulted from absences and new enrollments in the special education classroom. S1, S2, and S3 constituting Group 1, and S4, S5, and S6, constituting

Group II, participated in session I. S1, S2, and S3 of Group I, and S4 and S5 of Group II participated in session II. S1, S2, and S3 of Group I and S4, and S6 of Group II participated in sessions 3 and 4. S1, S3, and S6 of Group 3 and S4, S7, and S8 of Group 4 participated in session 5. S2 and S3 of Group I and S4, S6, and S7 of Group 5 participated in session 6. S1, S2, and S3 of Group I and S4, S7, and S8 of Group 6 participated in session 7.

Results

The results for sessions 1-4 are presented in figure 4. Data from session I are identified by the graph headed: Results I; data from session 2 by the graph headed: Results II; data from session 3 by the graph headed: Results III; and data from session 4 by the graph headed: Results IV. A solid line represents task rates for one group and the broken line the rates for the other group. Groups are identified at graph headings.

- - - - - - - - - - - - - - - - - - -

Insert Figure 4 about here

- - - - - - - - - - - - - - - - - - -

Data from session I do not demonstrate consistently expected variations in cooperative rates during 1 point for higher (A), 1 point for lower (B), 1 point for higher (A) outcome conditions. The mean rates of Group I during this A-B-A sequence were: 354, 359, and 171; and for Group 2, 350, 300, and 435. Group 2's task rates were as expected, a decrease during B and an increase during subsequent A, but group I's task rates were not.

Data from sessions 2, 3, and 4 similarly did not demonstrate consistently expected variations. The A-B-A sequence was: 1 point for a <u>higher</u> outcome (A), 2 points for a <u>lower</u> outcome (B), and 1 point for a <u>higher</u> outcome (A).

The mean rates for Group I durig the A-B-A sequence for session 2 were: 394, 92, 319; and for Group 2 the rates were 27, 86, and 91. One Group's rates were a s predicted but the other's were not. The mean rates for Group I in Session 3 were: 629, 519, and 374; - and for Group 2 were 291, 318, and 286. Task rates were not in accord with expectations for either group.

The mean rates for Group I during Session 4 were: 589, 458, and 555; and for Group 2 were: 151, 224, and 188. The task rates for one of the two groups changed as expected: decreased and then increased as contingencies changed from 1 point for a higher task outcome to 2 points for a lower outcome, and from 2 points for a lower task outcome to 1 point for a higher outcome.

The results for sessions 5-7 are presented in figure 5. Data from session 5 are identified by the graph headed: Results V; for session 6 by the graph headed: Results VI; and for session 7 by the graph headed: Results VII. A solid line represents output rates for one group and the broken line the rates for the other group. Groups are identified at graph headings.

- - - - - - - - - - - - - - - - - - -

Insert Figure 5 about here

- - - - - - - - - - - - - - - - - - -

The contingency sequence for sessions 5, 6, and 7 was: 1 point for a higher outcome (A), 3 points for a lower outcome (B), and 1 point for a higher outcome (A). Cooperative rates changed predictably with changes in conditions for each group in the three sessions. The mean rates of Group 3 during the A-B-A sequence for session 5 were: 362, 117, and 381; and for Group 4 were: 166, 126, and 250. The rates of Group I during the A-B-A sequence for session 6 were: 505, 1, and 370; and for Group 5 were: 365,

2, and 335. The rates of Group 1 during the A-B-A sequence for session 7 were: 602, 20, and 615; and for Group 6 were: 184, 26 and 223.

Discussion

The procedures employed in study III provided competitive reward contingencies for three conditions of the A-B-A sequence, but changed the magnitude of the reward in the B condition only. As the magnitude of the reward increased from sessions 1-7, control of the intra-group cooperation was observed, with predictable control of cooperative rates occurring in each group during sessions 5-7. Here the reward magnitude for a lesser outcome was 3 points.

Summary

The purpose of the present investigation has been to explore the effects on group output of reward magnitude in two-group competitive situations. Two studies designed to examine this parameter offered partial support for the notion that a greater reward for a comparative outcome increases the probability that group task rates will change predictably with changes in the contingency. In studies I and II the contingency changes were: no reward contingency (A), reward contingency (B), no-reward contingency (A). During reward contingency conditions reward magnitudes varied from 1, 2, and 3 points for a higher outcome (study I) to 1, 2, and 3 points for a lower outcome (study II). Predictable control of intra-group cooperation was not demonstrated consistently for all groups.

In study III procedures of study I and II were combined with competitive reward contingencies functioning during each condition of the A-B-A condition

sequence. During A conditions a 1 point reward for a higher comparison outcome was introduced and during B conditions a 1, 2, and 3 point reward for a lower comparison outcome was introduced. Predictable control of task rates for each group was demonstrated for the 3 point reward only. With lesser magnitudes, 1 and 2 point rewards, cooperative rates changed as expected for some groups but not for others. These data suggest that reward magnitude during competitive contingencies can affect group task rates in predictable ways, i.e., the greater the reward for a lower comparison outcome, the more likely that a group task rate will decrease.

Figure Captions

Fig. 1. Student Console.

Fig. 2. During results I, II, and III, 100 points on a task counter returned one reward point to the person operating that console. For Condition B of Results I, 1 extra reward point was delivered to members of the group achieving a higher number of points on the group counter for a given trial. For Condition B of Results II, 2 reward points were delivered, and for Condition B of Results III, 3 reward points were delivered.

Fig. 3. During Results I, II, and III, 100 points on a task counter returned one reward point to the person operating that console. For Condition B of Results I, 1 extra reward point was delivered to members of the group achieving a lower number of points on the group counter for a given trial. For Condition B of Results II, 2 reward points were delivered, and for Condition B of Results III, 3 reward points were delivered.

Fig. 4. During Results I, II, III, and IV, 100 points on a task counter returned one reward point to the person operating that console. For Condition A of Results I, II, III, and IV, 1 extra reward point was delivered to members of the group achieving a higher number of points on the group counter for a given trial. For Condition B of Results I, 1 extra reward point was delivered to members of the group achieving a lower number of points on the group counter for a given trial. For Condition B of Results II, III, and IV, 2 extra reward points were

delivered to members of the group achieving a lower number of points on the group counter for a given trial.

Fig. 5. During Results V, VI, and VII, 100 points on a task counter returned one reward point to the person operating that console. For Condition A of Results V, VI, and VII, 1 extra reward point was delivered to members of the group achieving a higher number of points on the group counter for a given trial. For Condition B of Results V, VI, and VII, 3 extra reward points were delivered to members of the group achieving a lower number of points on the group counter for a given trial.

References

Azrin, N. H., & Lindsley, O. R. The reinforcement of cooperation between children. *Journal of Abnormal Social Psychology*, 1956, *52*, 100-102.

Cohen, D. J. Justin and his peers: An experimental analysis of a child's social world. *Child Development*, 1962, *33*, 697-717.

Cohen, D. J., & Lindsley, O. R. Catalysis of controlled leadership in cooperation by human stimulation. *Journal of Child Psychology and Psychiatry*, 1965, *5*, 119-137.

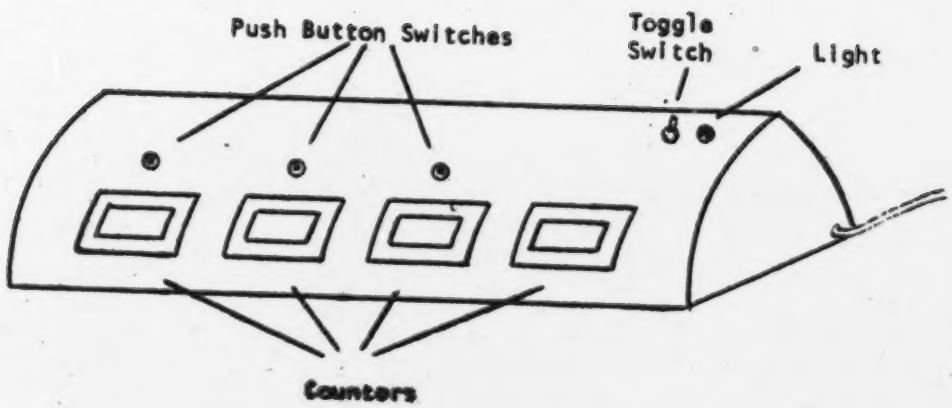
Lindsley, O. R. Experimental analysis of cooperation and competition. In Thom Verhave (Ed.), *The experimental analysis of behavior*. New York: Appleton-Century-Crofts, 1966, pp. 470-501.

Mithaug, D. E. The development of cooperation in alternative task situations. *Journal of Experimental Child Psychology*, 1969, *8*, 443-460.

Mithaug, D. E., & Burgess, R. L. Effects of different reinforcement procedures in the establishment of a group response. *Journal of Experimental Child Psychology*, 1967, *5*, 441-458.

Mithaug, D. E., & Burgess, R. L. The effects of different reinforcement contingencies in the development of social cooperation. *Journal of Experimental Child Psychology*, 1968, *6*, 402-426.

Stewart, J. E., Zelman, W. N. & Mithaug, D. E. The effects of different competitive contingencies on cooperative behavior. *Journal of Experimental Child Psychology*, 1971, in press.



STUDENT CONSOLE

FIGURE 1

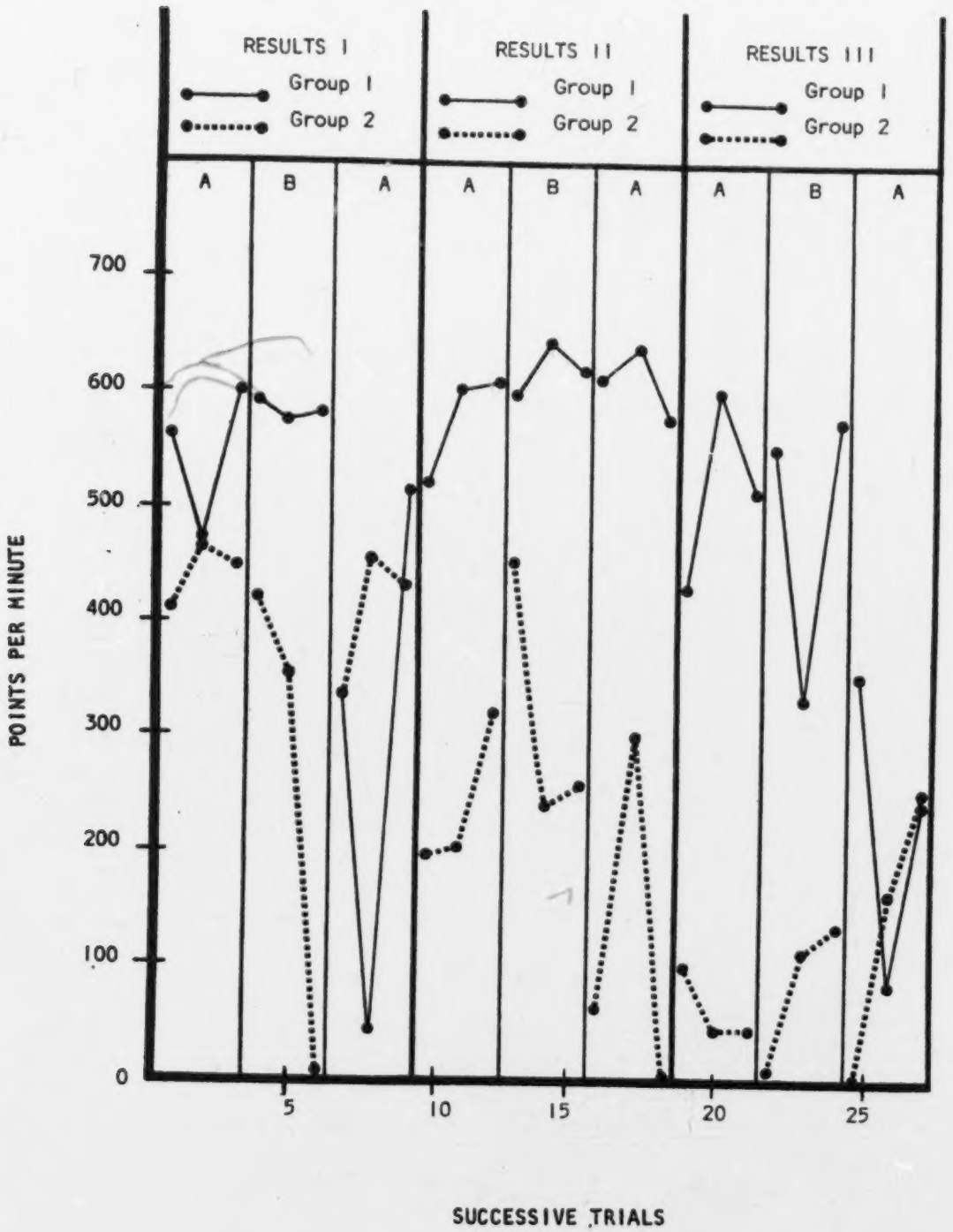

RESULTS I
Group 1
Group 2
RESULTS II
Group 1
Group 2
RESULTS III
Group 1
Group 2
A
B
A
A
B
A
A
B
A
700
600
500
400
300
200
100
0
5
10
15
20
25
POINTS PER MINUTE
SUCCESSIVE TRIALS

FIGURE 2

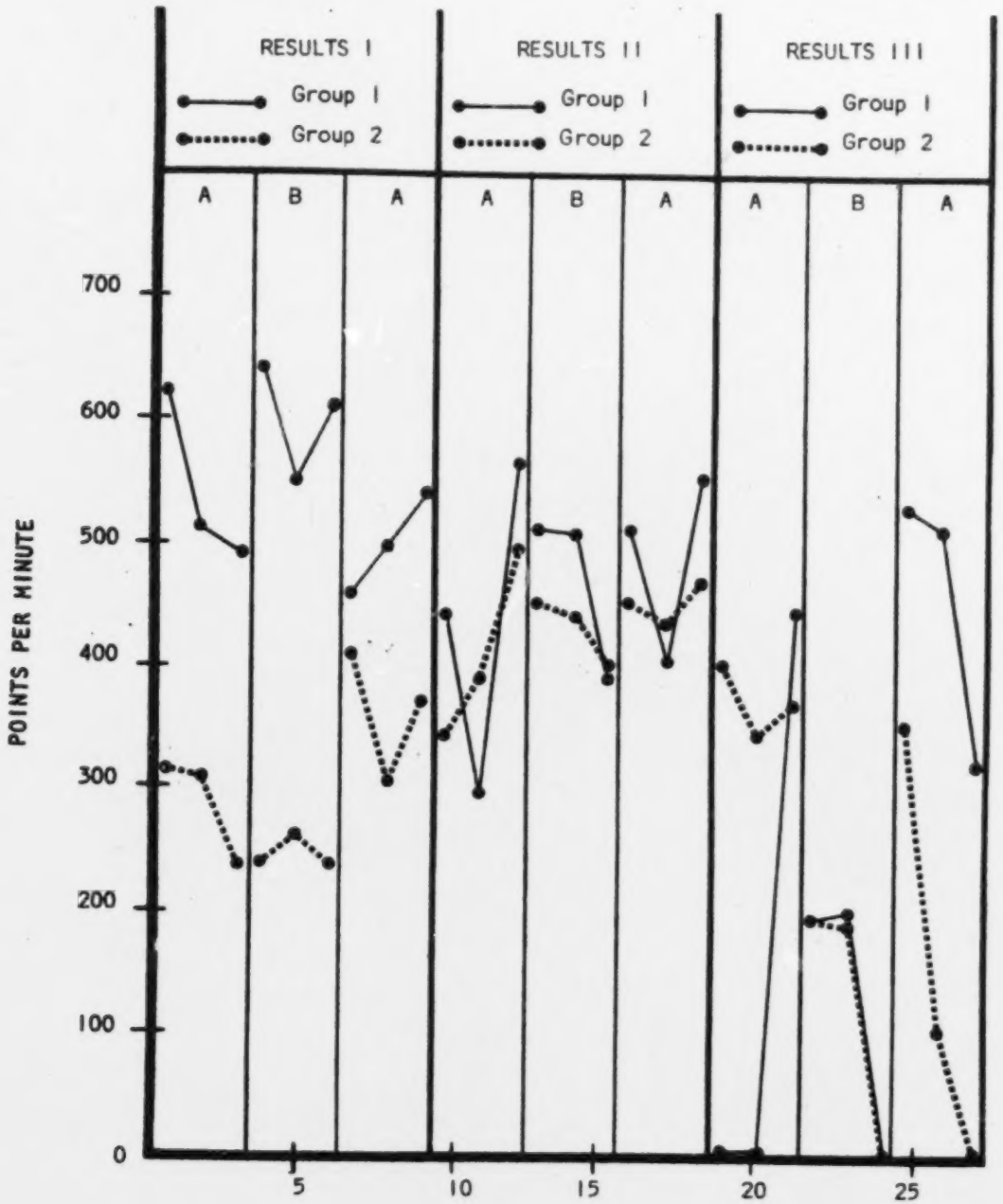

RESULTS I
RESULTS II
RESULTS III
Group 1
Group 2
A
B
A
700
600
500
400
300
200
100
0
POINTS PER MINUTE
5
10
15
20
25
SUCCESSIVE TRIALS

FIGURE 3

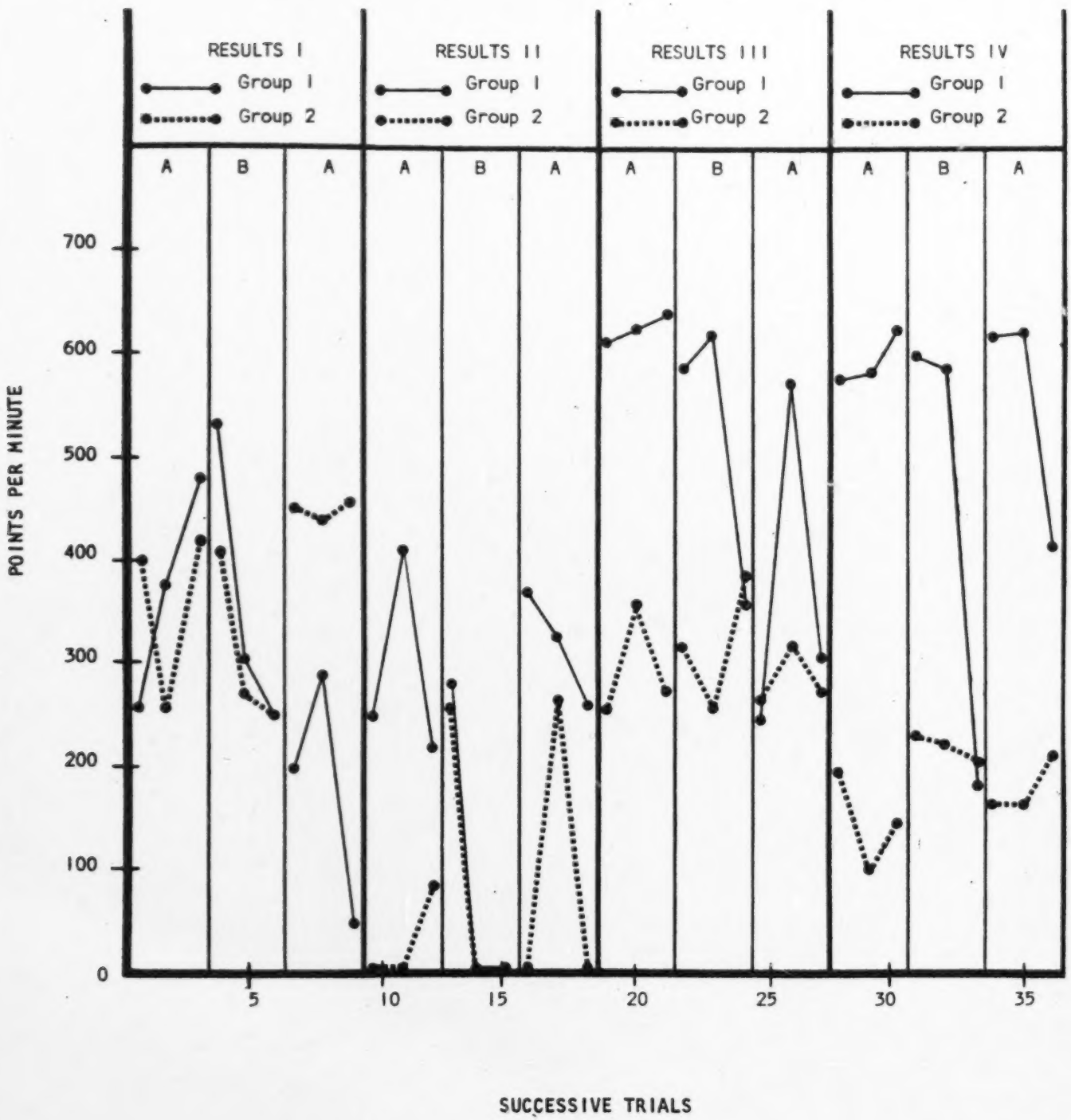

RESULTS I
Group 1
Group 2
RESULTS II
Group 1
Group 2
RESULTS III
Group 1
Group 2
RESULTS IV
Group 1
Group 2
A
B
A
A
B
A
A
B
A
A
B
A
700
600
500
400
300
200
100
0
POINTS PER MINUTE
5
10
15
20
25
30
35
SUCCESSIVE TRIALS

FIGURE 4

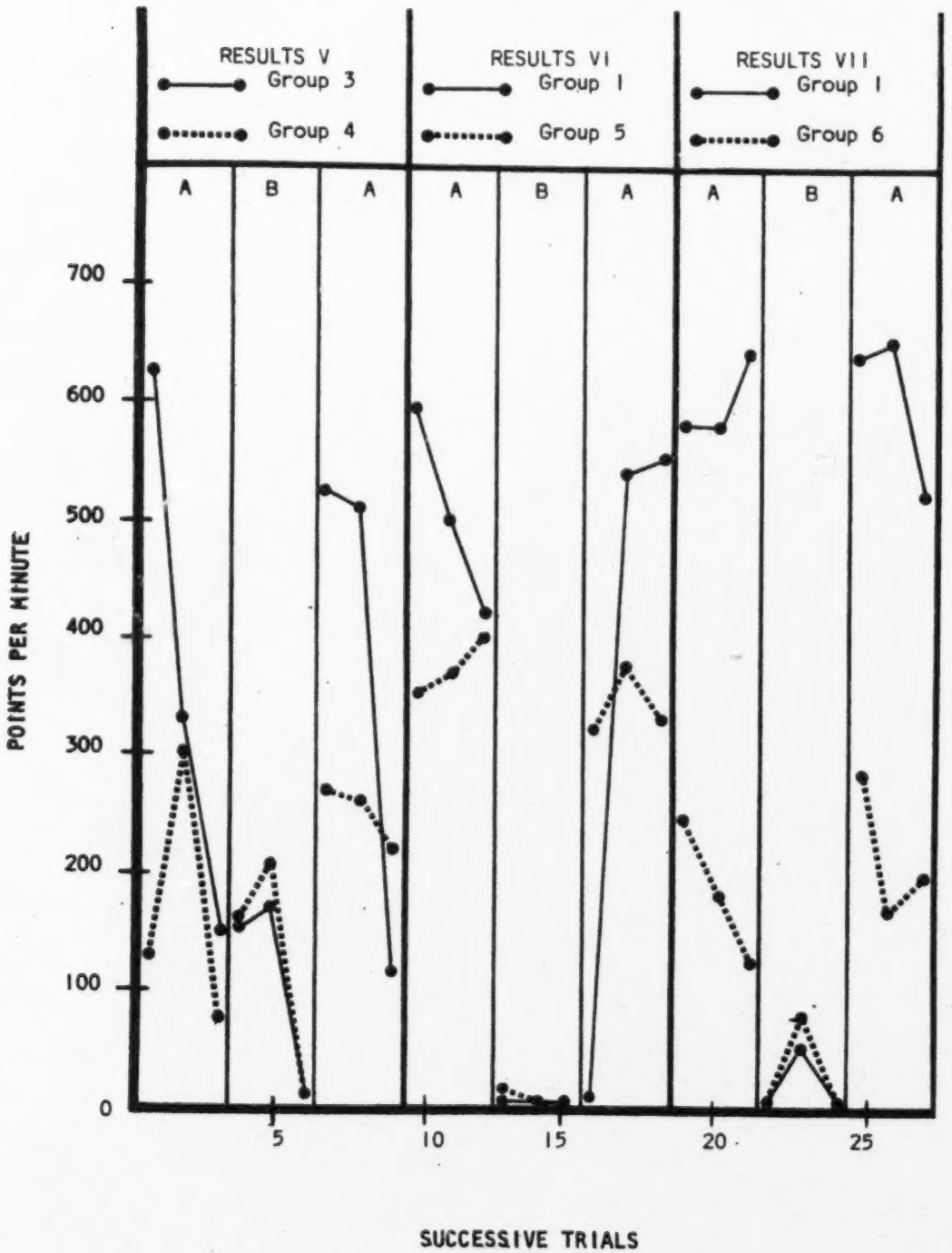

RESULTS V
Group 3
Group 4
RESULTS VI
Group 1
Group 5
RESULTS VII
Group 1
Group 6
A
B
A
A
B
A
A
B
A
700
600
500
400
300
200
100
0
5
10
15
20
25
POINTS PER MINUTE
SUCCESSIVE TRIALS

FIGURE 5